WHAT IS CLAIMED IS:

1. A method for forming an aperture plate, the method comprising:

providing a mandrel comprising a plate body having a conductive surface and a plurality of non-conductive islands disposed on the conductive surface, wherein the islands extend above the conductive surface and are sloped relative to the conductive surface;

placing the mandrel within a solution containing a material that is to be deposited onto the mandrel;

applying electrical current to the mandrel to form an aperture plate on the mandrel, wherein the apertures have an exit angle that is in the range from about 30° to about 60°.

2. A method as in claim 1, wherein the islands have a geometry that approaches a generally conical shape, and wherein the islands have a base diameter in the range from about 20 microns to about 200 microns and a height in the range from about 4 microns to about 20 microns.

3. A method as in claim 1, wherein the islands have an average slope in the range from about 15° to about 30° relative to the conductive surface.

4. A method as in claim 3, further comprising forming the islands from a photoresist material using a photolithography process.

5. A method as in claim 4, further comprising treating the islands following the photolithography process to alter the shape of the islands.

6. A method as in claim 1, further comprising removing the deposited aperture plate from the mandrel and forming a dome shape in the aperture plate.

7. A method as in claim 1, wherein the material in the solution is selected from a group of materials consisting of palladium, palladium nickel, and palladium alloys.

8. A method as in claim 1, wherein the apertures have an exit angle that is in the range from about 41° to about 49°.

9. An aperture plate formed according to the process of claim 1.

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10. An aperture plate comprising:

a plate body having a top surface, a bottom surface, and a plurality of apertures extending from the top surface to the bottom surface, wherein the apertures are tapered in a direction from the top surface to the bottom surface, and wherein the apertures have an exit angle that is in the range from about 30° to about 60°, and a diameter that is in the range from about 1 micron to about 10 microns at the narrowest portion of the taper.

11. An aperture plate as in claim 10, wherein the plate body is constructed from materials selected from a group consisting of palladium, palladium nickel and palladium alloys.

12. An aperture plate as in claim 10, wherein the plate body includes a portion that is dome shaped in geometry.

13. An aperture plate as in claim 10, wherein the plate body has a thickness in the range from about 20 microns to about 70 microns.

14. An aperture plate as in claim 10, wherein the apertures have an exit angle that is in the range from about 41° to about 49°.

15. A mandrel for forming an aperture plate, the mandrel comprising:

a mandrel body having a conductive, generally flat top surface and a plurality of non-conductive islands disposed on the conductive surface, wherein the islands extend above the conductive surface and have a geometry approaching a generally conical shape.

16. A mandrel as in claim 15, wherein the islands have a base diameter in the range from about 20 microns to about 200 microns, a height in the range from about 4 microns to about 20 microns.

17. A mandrel as in claim 15, wherein the islands are formed from a photoresist material using a photolithography process.

18. A method as in claim 17, wherein the islands are treated following the photolithography process to alter the shape of the islands.

19. A method for producing a mandrel that is adapted to form an aperture plate, the method comprising:

a) providing an electroforming mandrel body;

b) applying a photoresist film to the mandrel body;

c) placing a mask having a pattern of circular regions over the photoresist film;

d) developing the photoresist film to form an arrangement of non-conductive islands corresponding to the location of the holes in the pattern; and

e) heating the mandrel body to permit the islands to melt and flow into a desired shape.

20. A method as in claim 19, further comprising repeating steps b) through e) where the pattern of circular regions of the mask are smaller.

21. A method as in claim 20, wherein the desired shape is generally conical.

22. A method as in claim 20, further comprising permitting the islands to cure before repeating the steps.

23. A method as in claim 20, further comprising heating the mandrel body until the islands have an average angle of taper that is in the range from about 15° to about 30°.

24. A method as in claim 19, wherein the photoresist film has a thickness in the range from about 4 microns to about 15 microns.

25. A method as in claim 19, wherein the mandrel body is heated to a temperature in the range from about 50°C to about 250° C for about 30 minutes.

26. A method as in claim 25, further comprising raising the temperature at a rate that is less than about 3°C per minute until reaching the desired range.

27. A method for aerosolizing a liquid, the method comprising:

providing an aperture plate comprising a plate body having a top surface, a bottom surface, and a plurality of apertures that taper in a direction from the top surface to the bottom surface, wherein the apertures have an exit angle that is in the range from about 30° to about 60°, and a diameter that is in the range from about 1 micron to about 10 microns at the narrowest portion of the taper;

supplying a liquid to the bottom surface of the aperture plate; and

vibrating the aperture plate to eject liquid droplets from the top surface.

28. A method as in claim 27, wherein the droplets have a size in the range from about 2 microns to about 10 microns.

29. A method as in claim 27, further comprising holding the supplied liquid to the bottom surface by surface tension forces until the liquid droplets are ejected from the top surface.

30. A method as in claim 27, wherein the aperture plate has a least about 1000 apertures which product droplets having a size in the range from about 2 microns to about 10 microns, and further comprising aerosolizing a volume of liquid in the range from about 4μL to about 30μL within a time of less than about one second.

31. An aperture plate comprising:

a plate body having a top surface, a bottom surface, and a plurality of apertures extending from the top surface to the bottom surface, wherein the apertures each include an upper portion and a lower portion, wherein the lower portion extends upwardly from the bottom surface and is generally concave in geometry, and wherein the upper portion is tapered in a direction from the top surface to the bottom surface and intersections with the lower portion.

32. An aperture plate as in claim 31, wherein upper portion has an angle of taper that is in the range from about 30° to about 60° at the intersection with the lower portion, and a diameter that is in the range from about 1 micron to about 10 microns at the intersection with the lower portion.

33. An aperture plate as in claim 32, wherein the lower portion has a diamter at the lower surface that is in the range from about 20 microns to about 200 microns, a height in the range from about 4 microns to about 20 microns.

34. An aperture plate as in claim 31, wherein the bottom surface is adpated to receive a liquid, and wherein the plate body is vibratable to eject liquid droplets from the front surface.

35. A method for ejecting droplets of liquid, the method comprising:

providing an aperture plate comprising a plate body having a top surface, a bottom surface, and a plurality of apertures that taper in a direction from the top surface to the bottom surface, wherein the apertures have an exit angle that is in the range from about 30° to about 60°, and a diameter that is in the range from about 1 micron to about 10 microns at the narrowest portion of the taper; and

forcing liquid through the apertures to eject liquid droplets from the front surface.

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